TLC

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,708	12/08/2003	Alex Nugent	1000-1214	3983

7590 07/19/2006

Ortiz & Lopez, PLLC
Patent Attorneys
P.O. Box 4484
Albuquerque, NM 87196-4484

EXAMINER	
COUGHLAN, PETER D	
ART UNIT	PAPER NUMBER
2129	

DATE MAILED: 07/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/730,708	NUGENT, ALEX	
	Examiner	Art Unit	
	Peter Coughlan	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 May 2006*.
2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 5-22* is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) *1-3 and 5-22* is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on *12/8/2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a)☐ All b)☐ Some * c)☐ None of:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

1. This office action is in response to an AMENDMENT entered May 4, 2006 for the patent application 10/730708 filed on December 8, 2003.

2. The Non-Final Office Action of April 6, 2006 is fully incorporated into this Final Office Action by reference.

Status of Claims

3. Claims 1-3, 5-22 are pending.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 3, 6 and 7 are rejected under 35 U.S.C. 102(b) (hereinafter referred to as **Nagahara**) being anticipated by Nagahara, 'Direct placement of suspended carbon nanotubes for nanometer-scale assembly'.

Claim 1.

Nagahara anticipates providing a physical neural network comprising at least one neuron and at least one synapse thereof, wherein said at least one synapse is formed from a plurality of nanoparticles disposed within a dielectric solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof; and transmitting at least one pulse generated from said at least one neuron to said at least one post-synaptic electrode of a said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection of said plurality of nanoparticles disposed within said dielectric solution and said at least one synapse thereof (**Nagahara**, page 3826:C1:35 through C2:8; The two electrodes and the gap between them are the pre and post electrodes and the synapse of applicant. By applying an electric supply, a connection between these two electrodes is generated by the CNTs which are in solution. This connection or link is the neuron.)

Claim 2.

Nagahara anticipates increasing an electrical frequency of said electric field applied to said at least one pre-synaptic electrode and said at least one post-synaptic electrode, in response to generating said at least one pulse said at least one neuron, thereby strengthening at least one nanoconnection of said plurality of nanoparticles

disposed within said dielectric solution and said at least one synapse thereof (**Nagahara**, page 3827 C1:26-36, p3826 C2:6-8 and Figs 3 and 4; By increasing the frequency the connection has lower contamination thus a strengthening between the nodes.).

Claim 3.

Nagahara anticipates forming a connection network from said plurality of nanoparticles by applying said electric field to said at least one pre-synaptic electrode and said at least one post-synaptic electrode associated with said plurality of nanoparticles (**Nagahara**, Page 3826 C1:35 through C2:8; Nanoparticles of applicant is equivalent to CNT of Nagahara. Applying the electrical field of applicant is equivalent to 1 MHz of Nagahara.).

Claim 6.

Nagahara anticipates providing a physical neural network comprising a plurality of neurons formed from a plurality of nanoconnections disposed within a dielectric solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode; activating said subsequent neuron in response to firing an initial neuron of said plurality of neurons, thereby increasing a voltage of a pre-synaptic electrode of said neuron, which causes a refractory pulse thereof to decrease a voltage of a post-synaptic electrode associated with said neuron and thus provides an

increased voltage between said pre-synaptic electrode of said preceding neurons and said post-synaptic electrode of said neuron (**Nagahara** page3827 C1:37 through C2:22; Increasing the voltage of applicant is equivalent to AC bias of Nagahara.).

Claim 7.

Nagahara teaches and activating subsequent neurons thereof in succession in order to produce an increased frequency of an electric field between subsequent pre-synaptic and post-synaptic electrodes thereof, thereby causing an increase in an alignment of at least one nanoconnection of said plurality of nanoconnections and a decrease in an electrode resistance between said subsequent pre-synaptic and post-synaptic electrodes thereof. (**Nagahara,** p3826 C2:6-8; With the connection being made the resistance will decrease.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5 and 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara, as set forth above, in view of Mehrotra ('Elements of Artificial Neural networks', referred to as **Mehrotra).**

Claims 5 and 8.

Nagahara does not teach physical neural network comprises an adaptive neural network. Mehrotra teaches physical neural network comprises an adaptive neural network (**Mehrotra**, pages 116-135). It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify teachings of Nagahara by illustrating in some detail the contents of an adaptive neural network is a subclass of neural networks as taught by Nagahara to teach physical neural network comprises an adaptive neural network.

The purpose being the adaptive neural network can be pruned to handle the task at hand.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(b) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 9, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara in view of Mehrotra, and further in view of Olson ('Directed placement of suspended carbon nanotubes for nanometer-scale assembly': referred to as **Nagahara**; 'Elements of Artificial Neural Networks', referred to as **Mehrotra**; 'Startup combines nanotechnology with neural nets', referred to as **Olsen**).

Claim 9.

Nagahara teaches configuring an adaptive physical neural network to comprise a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof (**Nagahara,** p3826 C1:35 through C2:8),

Nagahara does not teach that said adaptive physical neural network.

Mehrotra teaches that said adaptive physical neural network. (**Mehrotra,** pages 116-135). It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Nagahara to include the design of the adaptive neural network of Mehrotra.

For the purpose of taking advantage of the dynamic connection ability of Nagahara and employing it into a adaptive neural network.

Nagahara and Mehrotra do not teach a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by a plurality of said nanoconnections; and providing an increased frequency of said applied electric field to strengthen said plurality of nanoparticles within said adaptive physical neural network regardless of a network topology thereof.

Olson teaches a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by a plurality of said nanoconnections; and providing an increased frequency of said applied electric field to strengthen said plurality of nanoparticles within said adaptive physical neural network regardless of a network topology thereof. (**Olson,** p1:1-15; The neural network of Olson contains a plurality of neurons and nanoconnections.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Nagahara and Mehrotra by using nanotechnology with neural networks as taught by Olson to have a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by a plurality of said nanoconnections; and providing an increased frequency of said applied

electric field to strengthen said plurality of nanoparticles within said adaptive physical neural network regardless of a network topology thereof.

For the purpose of combining the details of neural networks and nanotechnology with the product from a startup company LowmTech LLC.

Claim 10.

Mehrotra teaches providing at least one output from at least one neuron of said plurality of neurons to an input of another neuron of said adaptive physical neural network (**Mehrotra**, p122:fig 4.9(a); EN There are 3 input nodes for a single output node.).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Nagahara, Mehrotra and Olson, as set forth above, and further in view of Tapang , referred to as **Tapang** (U. S. Patent 4926064)

Claim 11.

Nagahara, Mehrotra and Olson do not teach automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof; comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value; and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said nanoconnections.

Tapang teaches automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof (**Tapang**, C8:58 through C9:2); comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value (**Tapang**, C10:17-45); and automatically grounding or

lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said nanoconnections (**Tapang**, C10:17-45; EN 'Grounding' of applicant is equivalent to 'pull down toward ground the voltage at its output point' of Tapang.). It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Nagahara, Mehrotra and Olson by illustrating the physics and design of the summation value with a comparator of the neural network as taught by Tapang to automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof; comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value; and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection

network and additionally experiences a higher frequency of activation in order to increase a strength of said nanoconnections.

For the purpose of describing in detail when the total sum of inputs are put into a comparator, and if a amount is higher than the voltage node the pulse is discharged.

Claim 12.

The combination of Nagahara, Mehrotra and Olson do not teach at least one neuron of said physical neural network comprises an integrator.

Tapang teaches at least one neuron of said physical neural network comprises an integrator (**Tapang**, C8:39-57). It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Nagahara, Mehrotra and Olson by having a device which fires a response within certain parameters as taught by Tapang to have at least one neuron of said physical neural network comprises an integrator.

For the purpose of having the neuron fire under a pre-synaptic condition of when neuron's excitation level is greater then the neuron's threshold value.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 13, 15, 16, 17, 21, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olson in view of Mehrotra ('Startup combines nanotechnology with neural nets': referred to as **Olson**; 'Elements of Artificial Neural networks', referred to as **Mehrotra**).

Claim 13.

Olson teaches providing a physical neural network comprising a plurality of neurons connected via a plurality of nanoconductors disposed within a dielectric solution to form at least one connection network of nanoconnections thereof, wherein said nanoconnections transfer signals. (**Olson,** 1-15; Olson illustrates an neural network composed of nanotechnology resulting in nanoconnections which in turn transfer signals.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Nagahara and Mehrotra by using nanotechnology in the form of neural networks as taught by Olson physical neural network until said at least one output changes to a desired output.

Mehrotra teaches presenting an input data set to said physical neural network to produce at least one output thereof; and increasing network activity within said physical neural network until said at least one output changes to a desired output (**Mehrotra**, p122:fig 4.9(a); EN There are 3 input nodes for a single output node.). It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify teachings of Nagahara by illustrating the basic design of a neural network as taught by Mehrotra to present an input data set to said physical neural network to produce at least one output thereof; and increasing network activity within said physical neural network until said at least one output changes to a desired output.

The purpose being to take advantage of dynamic connections ability to generate an adaptive neural network.

Claim 15.

Olson teaches plurality of neurons comprises a plurality of interconnected neurons that are interconnected by said nanoconnections, each of said nanoconnections being associated with a weight; and said increasing said network activity within said physical neural network includes scaling a weight associated with said nanoconnections by a positive factor. (**Olson,** 1-15; 'Weight' of applicant is equivalent to 'strenghten or weaken connections' of Olson. 'Positive factor' of applicant is equivalent to 'electrical fields' and their effect on nanoparticles.)

Claim 16.

Olson teaches plurality of neurons comprises a plurality of interconnected neurons that are interconnected by nanconnections for transferring signals having a magnitude in a firing state (**Olson,** 1-15; Neural networks that are composed on nanotechnology are comprise of interconnecting neurons and nanoconnections. 'Magnitude' of applicant is equivalent to 'strenghten or weaken' of Olson.); and said increasing said network activity within said physical neural network includes increasing said magnitude of said signal in said firing state. (**Olson,** 'Increasing said magnitude' of applicant is equivalent to 'increasing electrical field' of Olson. Resulting in increased signal of applicant or strengthen connections of Olson.)

Claim 17.

Olson teaches said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by a plurality of data input neurons thereof adapted to receive respective external signals (**Olson,** 1-15; 'Neurons' and 'interconnected neurons' of applicant is equivalent to 'neural network' of Olson.); said increasing said network activity within said physical neural network includes increasing a magnitude of said respective external signals. (**Olson,** 1-15; 'Increasing a magnitude of said respective external signals' of applicant is equivalent to increasing electrical fields of Olson.)

Claim 21.

Olson does not teach providing said desired output data; and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output.

Mehrotra teaches providing said desired output data (**Mehrotra,** p116:1-6; 'Desired output data' of applicant is equivalent ton 'training samples are needed' of Mehrotra.); and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output. (**Mehrotra,** p118:23-34; Using comparing symbols like 'less than' or 'subset' is one way to compare output data with desired output.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Olson by introducing training data for the neural nework as taught by Mehrotra to provide said desired output data; and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output.

For the purpose of providing the ability of the neural network to learn new functions or situations.

Claim 22.

Olson teaches the physical neural network comprises an adaptive neural network. (**Olson,** 1-15)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 14, 18, 19, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Olson and Mehrotra, as set forth above, in view of Nagahara. ('Directed placement of suspended carbon nanotubes for nanoscale assembly', referred to as **Nagahara**)

Claim 14.

Olson and Mehrotra do not teach increasing said network activity within said physical neural network, further comprises the step of increasing a number of firing neurons in said physical neural network.

Nagahara teaches increasing said network activity within said physical neural network, further comprises the step of increasing a number of firing neurons in said physical neural network. (**Nagahara,** p3826, C1:20 through C2:8; 'Increase of network

activity' of applicant is equivalent to 'placement yield' of Nagahara. 'Increasing the number of firings' of applicant is equivalent to 'applying a dc bias' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Olson and Mehrotra by making a direct correlation between the number of firing neurons and 'network activity' as taught by Nagahara to illustrate increasing said network activity within said physical neural network, further comprises the step of increasing a number of firing neurons in said physical neural network.

For the purpose of illustrating a direct correlation between firing neurons and 'network activity'.

Claim 18.

Mehrotra and Olson do not teach said plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold; and said increasing said network activity within said physical neural network includes lowering said threshold.

Nagahara teaches said plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold (**Nagahara,** p3827, C1:26-36; 'Excitation level' of applicant is equivalent to 'above 1 MH' of Nagahara.); and said increasing said network activity within said physical neural

network includes lowering said threshold. (**Nagahara,** p3826, C2:6-8; 'Increase network activity' and 'lower threshold' of applicant is equivalent to 'choice of frequency' and 'dramatically enhances' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Mehrotra and Olson by illustrating by using the correct frequency will enhance encourage the placement of nanoparticles between the electrones as taught by Nagahara to have plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold; and said increasing said network activity within said physical neural network includes lowering said threshold.

For the purpose of using electrical fields to generate connections between electrodes and using the fact that until a given level of electrical field is applied a connection will not be formed can be seen as a threshold.

Claim 19.

The combination of Mehrotra and Olson do not teach determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections, said nanoconnections being associated with respective weights, and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval.

Nagahara teaches determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections, said nanoconnections being associated with respective weights (**Nagahara,** p3836 C1:35 through C2:8, With the use of additional inputs into one electrode would be the equivalent to 'weighted sum' of applicant.), and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval. (**Nagahara,** abstract; The completed nanoscale wiring would be completed within seconds.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Mehrotra and Olson by using combined input as combined weights as taught by Nagahara to determine said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections, said nanoconnections being associated with respective weights, and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval.

For the purpose of using the combined electrical input as combined weights for use in a neural network.

Claim 20.

The combination of Mehrotra and Olson do not teach increasing said network activity within said physical neural network in response to a signal.

Nagahara teaches increasing said network activity within said physical neural network in response to a signal. (**Nagahara,** 'Increasing activity' and 'response to a signal' of applicant is equivalent to 'placement of CNT' and 'choice of frequency' of Nagahara.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify combined teachings of Mehrotra and Olson by stating the relationship between electrical input and connections between electrodes as taught by Nagahara to have increasing said network activity within said physical neural network in response to a signal.

For the purpose of electrical input as a mechanism for generating a connection between electrodes.

Response to Arguments

5. Applicant's arguments filed on May 4, 2006 for claims 1-3, 5-22 have been fully considered but are not persuasive.

6. In reference to the Applicant's argument:

Claims 1, 2, 3, 6, and 7 were rejected by the Examiner under 35 U.S.C. 102(b) as being anticipated by Nagahara, "Direct Placement of Suspended Carbon Nanometer-scale Assembly" hereinafter referred to a Nagahara.

With respect to claim 1, the Examiner argued that Nagahara anticipates providing a physical neural network comprising at least one neuron and at least one synapse thereof, wherein said at least one synapse is formed from a plurality of nanoparticles disposed within a dielectric solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode thereof and an electric field applied thereof; and transmitting at least one pulse generated from said at least one neuron to said at least one post-synaptic electrode of e said at least one neuron and said at least one pre-synaptic electrode of said at least one neuron of said physical neural network, thereby strengthening at least one nanoconnection of said plurality of nanoparticles disposed within said dielectric solution and said at least one synapse thereof.

In support of this argument, the Examiner cited Nagahara at page 3826, Column 1, Lines 1-35 through Column 2, Line 8, and argued that the two electrodes and the gap between them are pre and post electrodes and the synapse as taught by Applicant's invention. The Examiner additionally asserted that by applying an electric supply, a connection between these two electrodes is generated by the CNT's which are in a solution. The Examiner argued that this connection or link is the neuron.

The Applicant respectfully disagrees with this assessment. One of the primary claim limitations of Applicant's claim 1 is a physical neural network. Nagahara at page 3826, Column 1, Lines 1-35 through Column 2, Line 8 does not make any mention of a physical neural network. Additionally, Nagahara at page 3826, Column 1, Lines 1-35 through Column 2, Line 8 does not teach or suggest any type of neural network. The "CNT" cited by the Examiner refers to "carbon nanotubes" no mention is made in Nagahara at page 3826, Column 1, Lines 1-35 through Column 2, Line 8 of a neural network nor adaptive,processing. Additionally, there is no mention in Nagahara of Applicant's claim 1 limitations such as a neuron and synapses. There is also no mention in Nagahara of any step or process for forming a physical neural network. It follows that if Nagahara does not teach neural network components such as neurons and synapses, Nagahara also does not teach, disclose or suggest other neural network components such as post synaptic and pre synaptic electrodes. There is in fact no mention of the terms "post synaptic" or "pre synaptic" in Nagahara. There is also no mention in Nagahara of any processing for strengthening one or more nanoconnections formed from nanoparticles with a dielectric solution and one or more synapses.

Regarding the Examiner's assertion that by applying an electric supply, a connection between these two electrodes is generated by the CNT's which are in a solution and that this connection or link Is a neuron, the Applicant notes that there is no teaching in Nagahara of any type of a neuron. A neuron is a component of neural network. Where is a neural network taught by Nagahara? Merely stating that two electrodes in a

solution with a connection constitute a neuron is incorrect without explaining how a neuron component is actually formed by these components and functions as a neuron as a part of a neural netw9ric. The Examiner has made a general assertion that Nagahara discloses a neuron without explaining how the resulting connection functions as a neuron as a part of a neural network as taught by Applicant's invention.

To provide more evidence that Nagahara does not teach a neural device and in fact teaches away from a neural device, it is important to note that Nagahara at Page 3826, Column 1, Lines 1-3 clearly states that the intended application of Nagahara is field emission displays. There is a very big difference between an adaptive neural network and a computer display! A computer display (i.e., field emission display) provides no capability of neural network and neural devices.

In further support that Nagahara does not intend to build an adaptive synapse, Nagahara clearly states that the intended device is thermally annealed (i.e., See Nagahara, P. 3827 Column 1, Line 23) Thermally anneal the connection implies that the liquid was evaporated and therefore removes the medium necessary for adaptation, unlike Applicant's invention in which a solution is utilized as a medium for adaptation.

The Applicant submits that the rejection to claim 1 under 35 U.S.C. 102 fails under the aforementioned prima facie anticipation test. The Applicant reminds the Examiner that in order to succeed in a rejection to a claim under 35 U.S.C. 102 based on a particular reference, the reference cited as a basis for the rejection must disclose each and every claim limitation of the rejected claim. If even one claim limitation, however seemingly insignificant, is not disclosed in the reference utilized as a basis for the rejection, the rejection under 35 V.S.C. 102 to the claim fails. Based on the foregoing, the Applicant believes that the rejection to claim 1. has been traversed because Nagahara does not disclose each and every claim limitation (e.g., neural network, neuron, synapse, pre and post synaptic electrodes, etc) as taught by Applicant's claim 1. The Applicant respectfully requests that the rejection to claim 1 under 35 U.S.C. 102 be withdrawn and claim 1 allowed.

Examiner's response:

Nagahara illustrates the basic construction of a neuron that parallels the applicant's design. Pre and post synaptic electrodes are the electrodes before and after the application of electricity. 'Nanoscale wiring' can have many uses that use wiring in general. A neural network can be one of those uses. The synapse is the junction between the two electrodes

7. In reference to the Applicant's argument:

With respect to claim 2, the Examiner argued that Nagahara anticipates increasing an electrical frequency of said electric field to said at least one pre-synaptic electrode and said at least one post-synaptic electrode, in response to generating said at least one pulse said at least one neuron, thereby strengthening at least one nanoconnection of said plurality of nanoparticles disposed within said dielectric solution and said at least one synapse thereof. In support of this argument, the Examiner cited Nagahara, page 3827, Column 1, Lines 26-36; page 3826, Column 2, Lines 6-8; and FIGS. 3-4, and argued that by increasing the frequency, the connection has lower contamination thus a strengthening between the nodes.

The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 2. As indicated above, neural network components such as a synapse, are not taught, disclosed or suggested by Nagahara. In particularly there is no disclosure of such neural network components at Nagahara, page 3827, Column 1, Lines 26-36; page 3826, Column 2, Lines 6--8; and FIGS. 3-4. Because there is no disclosure of neural network components such as a synapse in Nagahara, the Applicant submits that the rejection to claim 2 fails under the aforementioned prima facie anticipation test. Based on the foregoing, the Applicant believes that the rejection to claim 2 has been traversed because Nagahara does not disclose each and every claim limitation (e.g., a synapse) as taught by Applicant's claim 2. The Applicant respectfully requests that the rejection to claim 2 under 35 U.S.G. 102 be withdrawn and claim 2 allowed.

In addition, the effect of removing contamination does not mean in any way that the connection has been strengthened. What if the contamination was more conducting that the desired nanoparticle? In fact, the equation given by Nagahara (i.e., see Nagahara, Page 3827, Column 2, Line 12) decreases In strength as the frequency is increased due to the real part of the Clausius-Mossotti factor and the changes in the complex permittivity between the nanotubes and the liquid suspension (Triton X-100).

Examiner's response:

Nagahara illustrates the basic construction of a neuron that parallels the applicant's design. The synapse is the junction between the two electrodes,

8. In reference to the Applicant's argument:

With respect to the rejection to claim 3, the Examiner argued that Nagahara anticipates forming a connection network from said plurality of nanoparticles by applying said electric field to said at least one pre-synaptic electrode and said at least one post-synaptic electrode associated with said plurality of nanoparticles. In support of this argument, the Examiner cited Nagahara, Page 3826, Column 1, Lines 35 through Column 2, Line 8 and argued that nanoparticies of Applicant's invention is equivalent to CNT of Nagahara and that by electrical field of Applicant's invention is equivalent to 1MHz of Nagahara.

The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 3. As indicated above, neural network components are not taught, disclosed or suggested by Nagahara. In particularly there is no disclosure of neural network components at Nagahara, Page 3826, Column 1, Lines 35 through Column 2, Line 8. Because there is no disclosure of neural network components in Nagahara, the Applicant submits that the rejection to claim 3 fails under the aforementioned prima fade anticipation test. Based on the foregoing, the Applicant believes that the rejection to claim 3 has been traversed because Nagahara does not disclose each and every claim limitation (e.g., a synapse) as taught by Applicant's claim 3, including the claim limitations of the claim from which claim 3 depends. The Applicant respectfully requests that the rejection to claim 3 under 35 U.S.C. 102 be withdrawn and claim 3 allowed..

Examiner's response:

The synapse is the junction between the two electrodes. Nagahara illustrates the basic construction of a neuron that parallels the applicant's design.

9. In reference to the Applicant's argument:

With respect to claim 6, the Examiner argued that Nagahara anticipates providing a physical neural network comprising a plurality of neurons formed from a plurality of nanoconnections disposed within a dielectric solution in association with at least one pre-synaptic electrode and at least one post-synaptic electrode; and activating said subsequent neuron in response to firing an initial neuron of said plurality of neurons, thereby increasing a voltage of a pre-synaptic electrode of said neuron, which causes a refractory pulse thereof to decrease a voltage of a post-synaptic electrode associated with said neuron and thus provides an increased voltage between said pre-synaptic electrode of said preceding neurons and said post-synaptic electrode of said neuron. In support of this argument, the Examiner cited page 3827, Column 1, Line 37 through Column 2, Line 22 of Nagahara and argued that the increasing the voltage of Applicant's invention is equivalent to the AC bias of Nagahara.

The Applicant respectfully disagrees with this assessment. Page 3827, Column 1, Line 37 through Column 2, Line 22 of Nagahara does not provide for any teaching of a physical neural network and neural network components such as neurons, pre and post synaptic electrodes, subsequent neurons, the firing of initial neurons, refractory pulses, preceding neurons and so forth. Additionally, the Examiner has not explained how increasing the voltage of Applicant's invention is equivalent to the AC bias of Nagahara, particularly in the context of neural networks which are not taught by Nagahara.

It should also be pointed out that the Nagahara reference at Page 3827, Column 1, Line 37 through Column 2, Line 22 provides a brief discussion of the physics of particles under electrostatic and dipole induced forces and in no case does Nagahara discuss a device (e.g., neuron) that provides feedback to a connection formed from the dipole-induced aggregation of nanoparticles in liquid environment. This is like saying that the television was unpatentable because it had previously been shown that electrons could be formed into a beam. It took incredible insight to realize that a control mechanism could be constructed around the electron beam to paint a picture. likewise, simply showing that particles can be aligned between two electrodes does not constitute proof that such physical organizational properties can be used as the basis for an adaptive synapse in a hybrid liquid/microelectronic device. The Examiner has not provided any evidence from Nagahara which indicates otherwise.

The Applicant submits that the rejection to claim 6 under 35 U.S.C. 102 fails under the aforementioned prima facie anticipation test. The Applicant reminds the Examiner that in order to succeed in a rejection to a claim under 35 U.S.C. 102 based on a particular reference, the reference cited as a basis for the rejection must disclose each and every claim limitation of the rejected claim. If even one claim limitation, however seemingly insignificant, is not disclosed in the reference utilized as a basis for the rejection, the rejection under 35 U.S.C. 102 to the claim fails. Based on the foregoing, the Applicant believes that the rejection to claim 6 has been traversed because Nagahara does not disclose each and every claim limitation (e.g., teaching of a physical neural network and neural network components such as neurons, pre and post synaptic electrodes,

subsequent neurons, the firing of initial neurons, refractory pulses, preceding neurons, etc) as taught by Applicant's claim 6. The Applicant respectfully requests that the rejection to claim 6 under 35 U.S.C, 102 be withdrawn and claim 6 allowed.

Examiner's response:

In Nagahara's abstract is the introduction of nanoscale wiring. Having wiring that can be generated within seconds falls in perfectly with an adaptive neural network design. The initial and final stages of both the applicant and Nagahara are parallel. Both have nanoparticles suspended in solution. In this solution are two electrodes and when electricity is connected between these two electrodes, the nanoparticles align themselves to make a connection between the two electrodes. Altering the electricity changes the nanoparticles placement.

10. In reference to the Applicant's argument:

Regarding claim 7, the Examiner argued that Nagahara teaches firing and activating subsequent neurons thereof in succession in order to produce an increased frequency of an electric field between subsequent pre-synaptic and post-synaptic electrodes thereof, thereby causing an increase in an alignment of at least one nanoconnection of said plurality of nanoconnections and a decrease in an electrode resistance between said subsequent pre-synaptic and post-synaptic electrodes thereof. In support of this argument, the Examiner cited Nagahara, page 3826 Column 2, lines 6-8 and argued that "with the connection being made the resistance will decrease".

The Applicant respectfully disagrees with this assessment. In order to teach firing and activating subsequent neurons, Nagahara must teach neurons. As indicated above Nagahara does not teach, disclose or suggest neural networks or neural .network components such as neurons. Page 3826 Column 2, lines 6-8 of Nagahara indicates that "with the appropriate choice of frequency, the use of ac bias dramatically enhances the placement of CNT's over other contaminant species In the solution". There is no teaching here of neurons and especially no teaching of firing and activating neurons.

The ability to fire and activate neurons Is a feature of a neural network. As indicated previously, a neural network is simply NOT taught, disclosed or suggested by Nagahara. The Examiner has not provided any evidence to the contrary.

The Applicant submits that the rejection to claim 7 under 35 U.S.C. 102 fails under the aforementioned prima facie anticipation test. The Applicant reminds the Examiner that in order to succeed in a rejection to a claim under 35 U.S.C. 102 based on a particular reference, the reference cited as a basis for the rejection must disclose each and every claim limitation of the rejected claim. If even one claim limitation, however seemingly insignificant, is not disclosed in the reference utilized as a basis for the rejection, the rejection under 35 U.S.C. 102 to the claim fails. Based on the foregoing, the Applicant believes that the rejection to claim 7 has been traversed because Nagahara does not disclose each and every, claim limitation (e.g., firing and activating of neurons) as taught by Applicant's claim 7 and Applicant's specification, which enables Applicant's claim 7. The Applicant respectfully requests that the rejection to claim 7 under 35 U.S.C. 102 be withdrawn and claim 7 allowed.

Examiner's response:

Nagahara illustrates the basic construction of a neuron that parallels the applicant's design. 'Firing and activating of neurons' of applicant is equivalent to 'applying a dc bias to trap nanoparticles' of Nagahara. The trapping of particles between the electrodes is the generation(activation) of the neuron.

11. In reference to the Applicant's argument:

II. Claim Rejections — 35 U.S.C. § 103
Requirements for Prima Facie Obviousness
The obligation of the examiner to go forward and produce reasoning and evidence in support of obviousness is clearly defined at M.P.E.P. §2142:

The examiner bears the initial burden of factually supporting any prima fade conclusion of obviousness. If the examiner does not produce a prima fade case, the applicant is under no obligation to submit evidence of nonobviousness.

M.P.E.P. §2143 sets out the three basic criteria that a patent examiner must satisfy to establish a prima fade case of obviousness:

some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;
a reasonable expectation of success; and
the teaching or suggestion of all the claim limitations by the prior art reference (or references when combined).

It follows that in the absence of such a prima facie showing of obviousness by the Examiner (assuming there are no objections or other grounds for rejection), an applicant is entitled to grant of a patent. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443 (Fed. Cir. 1992). Thus, in order to support an obviousness rejection, the Examiner is obliged to produce evidence compelling a conclusion that each of the three aforementioned basic criteria has been met.

Examiner's response:

In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

12. In reference to the Applicant's argument:

Nagahara In view of Mehrotra

Claims 5 and 8 were rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over Nagahara, as set forth above, in view of Mehrotra, "Elements of Artificial Neural Networks").

Regarding claims 5 and 8, the Examiner admitted that Nagahara does not teach a physical neural network comprising adaptive neural network (NOTE: As indicated earlier Nagahara does not teach any neural network). The Examiner argued that Mehrotra teaches a physical neural network comprising an adaptive neural network. In support of this argument, the Examiner cited Mehrotra, pages 116-135.

The Examiner argued that it would have been obvious to a person having ordinary skill in the art at the time of the Applicant's invention to modify the teachings of Nagahara (NOTE: Again, as indicated earlier, Nagahara does not teach any neural network) by illustrating in some detail the contents of an adaptive neural network is a subclass of neural networks as taught by Nagahara (NOTE: Again, as indicated earlier, Nagahara does not teach any neural network) to teach physical neural network comprises an adaptive neural network. The Examiner asserted the purpose being the adaptive neural network can be pruned to handle the task at hand.

In reference to the Applicant's argument in the prior office action, the Examiner asserted that Mehrotra teaches the components and design of an adaptive neural network. The Examiner stated that he does not claim that Mehrotra comprises nanotechnology but that Mehrotra teaches neural networks. The Examiner asserted that the combination of Mehrotra and Nagahara is obvious. The Examiner argued that Mehrotra teaches algorithms due to the fact the author uses software based neural networks as an example but does not limit them to software only, The Examiner argued that it would be more obvious to combine an adaptive neural network design rather than a standard neural network design with that of Nagahara. The Examiner argued that due to the fact that Nagahara has the property of making connections between electrodes when required. The Examiner further asserted that in terms of training Mehrotra uses the example of software based neural networks. The Examiner also asserted that Mehrotra does not limit the existence to software based systems only. The Examiner argued that the combination of the adaptive neural networks of Mehrotra and dynamic abilities of Nagahara is obvious.

The Applicant respectfully disagrees with this assessment. As indicated previously, Nagahara does not provide for any teaching of a physical neural network, let alone a neural network. Contrary to the Examiner's assertion that Mehrotra does not limit the existence of a neural network to software based systems, the Applicant has reviewed Mehrotra and finds no teaching for any implementation of a physical neural network. Mehrotra is limited to algorithms for implementing neural networks not actual hardware components, This is why we distinguish between "software" and "real" or physical neural networks. Page 116 of Mehrotra refers several times to "algorithms". A software neural network is not a physical neural network. An algorithm, even one implemented on a computer, is not a true physical neural network as taught by Applicant's invention but is instead a simulation of a neural network, not an actual physical neural network, such as, for example, a human brain. Applicant's "background" section describes the difference between software and physical neural networks. Applicant's paragraph 5, for example explains the following:

"In general, artificial neural networks are systems composed of many nonlinear computational elements operating in parallel and arranged in patterns reminiscent of biological neural nets. The computational elements, or nodes, are connected via variable weights that are typically adapted during use to improve performance. Thus, in solving a problem, neural net models can explore many competing hypothesis simultaneously using massively parallel nets composed of many computational elements connected by links with variable weights. In contrast, with conventional von Neumann computers, an algorithm must first be developed manually, and a program of instructions written and executed sequentially. In some applications, this has proved extremely difficult. This makes conventional computers unsuitable for many real-time problems for which we have no efficient algorithm."

Applicant's paragraphs 8-10 explain the following:

"Neural networks that have been developed to date are largely software-based. A true neural network (e.g., the human brain) is massively parallel (and therefore very fast computationally) and very adaptable, For example, half of a human brain can suffer a lesion early in its development and not seriously affect Its performance. Software simulations are slow because during the learning phase a standard computer must serially calculate connection strengths.

When the networks become larger (and therefore more powerful and useful), the computational time becomes enormous. For example, networks with 10,000 connections can easily overwhelm a computer. In comparison, the human brain has about 100 billion neurons, each of which can be connected to about 5,000 other neurons, On the other hand, if a network is trained to perform a specific task, perhaps taking many days or months to train, the final useful result can be built or "downloaded" onto a piece of hardware and also mass-produced. Because most problems requiring complex pattern recognition are highly specific, networks are task-specific. Thus, users usually provide their own, task-specific training data.

A number of software simulations of neural networks have been developed. Because software simulations are performed on conventional sequential com utters,, however,

they do not take advantage of the inherent parallelism of neural network architectures. Consequently, they are relatively slow. One frequently used measurement of the speed of a neural network processor is the number of interconnections it can perform per second. For example, the fastest software simulations available can perform up to approximately 18 million interconnects per second. Such speeds, however, currently require expensive super computers, to achieve. Even so, approximately 18 million interconnects per second is still too slow to perform many classes of pattern classification tasks in real time. These include radar target classifications, sonar target classification, automatic speaker identification, automatic speech recognition, electro-cardiogram analysis, etc."

The Applicant suggests that the Examiner re-read the background section of Applicant's specification to understand the difference between a simulation of a neural network software/algorithm) and an actual physical, neural network (e.g., the human brain or Applicant's invention as claimed). As a quick example, consider the act of determining the result of a car crash. In one case, the car can be modeled in a computer: physical properties such as mass and bulk modulus can be assigned to components within the car. A very large computer can then use known physics to compute the outcome. Because of the tremendous complexity of the crash due to the many thousands on interacting components, the simulation will take a very long time and produce questionable results. On the other hand, the car could simply be crashed for real, the result taking only a split second. In terms of the relation to a large neural network, the complexity of the networks required for capable functions equivalent to biological systems are so large that a computer simulation Is fruitless and completely intractable. The most computationally intensive aspect to a large neural simulation, due to the tremendous memory bandwidth required, is the adaptive property. It is not possible using traditional computing technology, of any form, to emulate 1,000,000,000,000,000 synapses adapting at upwards of 100 times a second. The memory bandwidth required far outstrips any current technology. This IS possible if the adaptive property of the synapse is inherent in the physics of the synapse, such as that disclosed by the Applicant.

Mehrotra teaches at a minimum simply an algorithm (see page 116 of Mehrotra) and at maximum only a simulation (software) of an arbitrary neural network algorithm, not a true physical neural network such as that taught by Applicant's invention. The Examiner has not cited any section of Mehrotra which teaches a true physical neural network as taught by Applicant's invention. As indicated earlier, Nagahara provides absolutely no teaching for a physical neural network and neural network components such as neurons, synapses and so forth. How and why would one be motivated to combine Nagahara with Mehrotra to derive all of the claim limitations, of Applicant's claims 5 and 8, if Nagahara does not teach neural networks and Mehrotra teaches away from physical neural networks and focuses only on algorithms that simulate neural networks? There is no teaching of any physical neural network components by Mehrotra that provide for a true physical neural network.

Based on the foregoing, the Applicant submits that the rejection to claims 5 and 8 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claims 5 and 8, including all of the claim limitations of the claims from which claims 5 and 8 depend. Second, there is not a reasonable expectation of success for such a combination, particularly In light of the fact that Nagahara provides absolutely no teaching or suggestion of neural networks and neural network components such as neurons, synapses, etc., and Mehrotra does not provide for any teaching and in fact teaches away from a physical neural network. Instead Mehrotra discusses an arbitrary neural network pruning algorithm intended to lower the computation constraints imposed on traditional computing platforms by the inherent parallelism of neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references In order to yield the invention as claimed. The rejection to claims 5 and Sunder 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claims 5 and 8 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claims 5 and 8.

Examiner's response:

Mehrotra teaches designs of neural networks. Neural networks can be software based or hardware based. In response to Applicant's argument that there is no

suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

13. In reference to the Applicant's argument:

Nagahara, Mehrotra, Olson

Claims 9 and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara in view of Mehrotra, and further in view of Olson "Startup Combines Nanotechnology With Neural Nets".

Regarding claim 9, the Examiner argued that Nagahara teaches configuring an adaptive physical neural network to comprise a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof. In support of this argument, the Examiner cited Nagahara, page 3826, Column 1, Line 35 through Column 2, Line 8).

The Examiner admitted that Nagahara does not teach an adaptive physical neural network. The Examiner argued, however, that Mehrotra teaches an adaptive physical neural network. In support of this argument, the Examiner cited Mehrotra, pages 116-

135). The Examiner argued that it would have been obvious to a person of ordinary skill in the art at the time of Applicant's invention to modify the combined teachings Nagahara to include the design of the adaptive neural network of Mehrotra.

The Examiner also asserted that "for the purpose of taking advantage of the dynamic connection ability of Nagahara and employing it into an adaptive neural network".

The Examiner admitted that Nagahara and Mehrotra do not teach a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanopartides experiences an alignment with respect to an applied electric field to form a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by a plurality of said nanoconnections; and providing an increased frequency of said applied electric field to strengthen said plurality of nanoparticles within said adaptive physical neural network regardless of a network topology, thereof.

The Examiner argued, however, that Olson teaches a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by a. plurality of said nanoconnections; and providing an increased frequency of said applied electric field to strengthen said plurality of nanoparticies within said adaptive physical neural network regardless of a network topology thereof. In support of this argument, the Examiner cited Olson, page 1, lines 1-15 and asserted that the neural network of Olson contains a plurality of neurons and nanoconnections.

The Examiner argued that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings of Nagahara and Mehrotra by using nanotechnology with neural networks as taught by Olson to have a plurality of nanoparticles located within a dielectric solution, wherein said plurality of nanoparticles experiences an alignment with respect to an applied electric field to form a connection network thereof, such that said adaptive physical neural network comprises a plurality of neurons interconnected by a plurality of said nano connections; and providing an increased frequency of said applied electric field to strengthen the. plurality of nanoparticles within the adaptive physical neural network regardless of a network topology thereof.

The Examiner argued that "for the purpose of combining the details of neural networks and nanotechnology with the product from a start-up company LownTech LLC".

Regarding claim 10, the Examiner argued that Mehrotra teaches providing at least one output from at least one neuron of said plurality of neurons to an input of another neuron of said adaptive physical neural network. The Examiner cited Mehrotra, page 122, FIG. 4.9(a) and provided an EN arguing that there are 3 input nodes for a single input node.

The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claims 5 and 8 under 35 U.S.C. 103(a) as being unpatentable over Nagahara in view of Mehrotra apply equally against the rejection to claims 9 and 10 under 35 U.S.C. 103(a). That is, Nagahara. does not provide for any teaching of a physical neural network, let alone a neural network. Contrary to the Examiner's assertion that Mehrotra does not limit the existence of a neural network to software based systems, the Applicant has reviewed Mehrotra and finds no teaching for any implementation of a physical neural network. Mehrotra is limited to algorithms for implementing a specific type of neural network and not actual hardware components and is operates under the assumption that a smaller neural network is a better neural network (see Page 116 First Sentence). This is why we distinguish between "software" and "real" or physical neural networks. The Applicant notes that the most capable neural networks are biological neural networks and that these networks contain many billions of neurons and thousands of trillions of synapses. The Applicant has disclosing an invention that will enable the construction of neural networks with comparable numbers of neurons and adaptive synapses. Mehrotra states specifically his intention to design small neural network algorithms (P. 116, first sentence) and the challenge is doing this. The entire Mehrotra reference is dedicated to pruning algorithms that are used to make a neural network smaller. It is therefore quite clear that Mehrotra is teaching away from a physical neural network as taught by Applicant's invention. A software neural network is simply not a physical neural network. An algorithm, as implemented on a computer is not a true physical neural network as taught by Applicant's invention but is instead a simulation of a neural network.

The Applicant again suggests that the Examiner re-read 'the background section of Applicant's specification to understand the difference between a simulation of a neural network (i.e., software/algorithm) and an actual physical neural network. Because Mehrotra does not provide any teaching of a physical neural network as taught by Applicant's specification and claims and in fact teaches away from physical neural networks, it can be concluded that Mehrotra provides no teaching of physical adaptive neural network.

Thus, Mehrotra teaches at a minimum simply an algorithm (see page 116 of Mehrotra) and at maximum only a simulation of a specific type of a neural network, not a true physical neural network such as that Wight by Applicant's invention. The Examiner has not cited any section of Mehrotra which teaches a ti to physical, neural network as taught by Applicant's invention. Page 122, FIG. 4.9(a) of Mehrotra cited by the Examiner and the EN provided by the Examiner do not provide any evidence of a phy_5jcat neural network as taught by Applicant's invention. In fact, FIG. 4.9(a) provides evidence to the contrary. FIG. 4.9(a) of Mehrotra refers to "Marchand's algorithm". Again, there is not evidence here of a physical neural network as taught by Applicant's specification. Where is a physical neural network shown at FIG. 4.9(a) and page 122 of Mehrotra?

As indicated earlier, Nagahara provides absolutely no teaching for a physical neural network and physical neural network components such as neurons, synapses and so forth. Him and why would one be motivated to combine Nagahara with Mehrotra to derive all of the claim limitaigng of Applicant's claims 9 and 10 Nagahara does nQt teach neural networks and Mehrotra teaches away from physical neural networks and focuses only on algorithms that simulate neural networks? There is simply ZLo teaching of any physical neural network by Mehrotra and/or Nagahara. Thus, it is improper to combine Mehrotra and Nagahara as suggested by the Examiner.

Examiner's response:

Mehrotra teaches designs of neural networks. Neural networks can be software based or hardware based. A hardware based neural network can be modeled into a software based neural network and visa versa. Mehrotra teaches designs of neural networks and can be implemented in either hardware of software based designs. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

14. In reference to the Applicant's argument:

Regarding the Olsen reference, the Applicant conceived of the subject matter of Olsen to the extent this novel concept may be claimed in claims 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22.

The Applicant submits herewith a declaration by Alex Nugent (hereinafter referred to as the "Nugent declaration") to antedate the effective date of September 18, 2002 of the Olsen reference, In accordance with 37 C.F.R. §1.131(a). The Nugent declaration is accompanied by Exhibit A forming part thereof that evidences both conception of the invention by Applicant prior to the effective date of September 18, 2002 of the Olsen reference.

Exhibit A of the Nugent declaration is a photocopy of U.S. published Patent Application No. US20030177450 and U.S. Patent No. 6,889,216 establishing constructive reduction to practice of the key element of the Olsen invention prior to the effective date of September 18, 2002 of the Olsen reference.

Therefore, given the Nugent declaration and Exhibit A, important subject matter of claims 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 that distinguishes Applicant's claimed invention over, the cited art, was conceived and reduced to practice via a patent filing by Applicant prior to the effective date of September 18, 2002 of the Olsen reference. Therefore, Olsen cannot be used to obviate claims 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22. Applicant respectfully requests that the rejection to claim 9 (and claims 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22) be withdrawn.

Examiner's response:

The applicant's declaration is deficient. Per the MPEP 37 C.F.R. §1.131(b)

'The showing of the facts shall be such, in character and weight, as to establish reduction to the practice prior to the effective date of the reference, or conception of the invention prior to the effective date of the reference coupled with due diligence from prior to said date to a subsequent reduction to practice or to the filing of the application. Original exhibits of drawings or records, or photocopies thereof, must accompany and form part of the affidavit or declaration or their absence must be satisfactorily explained.'

Applicant offers no statement of facts such as copies or original log books or drawings. There is no evidence of applicant's ownership of stated company. Applicant

also states that 'Exhibit A' was submitted but there exists no record of it being received.

The applicant's declaration is not accepted.

15. In reference to the Applicant's argument:

Nagahara, Mehrotra, Olson, Tapang

Claims 11 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Nagahara, Mehrotra, and Olson, as set forth above, and further in view of Tapang (U.S. Patent No. 4,926,064).

Regarding claim 11, the Examiner admitted that Nagahara, Mehrotra, and Olson do note teach automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof; comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value; and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to Increase a strength of said nanoconnections.

The Examiner argued, however, that Tapang teaches automatically summing at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof (citing Tapang, Column 8, Line 58 through Column 9, Line 2); comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value (citing Tapang, Column 10, lines 17-45); and automatically grounding or lowering to -Vcc a post synaptic junction associated with said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said nanoconnections (citing Tapang, Column 10, Lines 17-45; and providing an EN arguing that the "grounding" of Applicant's invention Is equivalent to a "pull down toward ground the voltage at its output point" of Tapang).

The Examiner asserted that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings of Nagahara, Mehrotra and Olson by illustrating the physics and design of the summation value with a comparator of the neural network as taught by Tapang to automatically sum at least one signal provided by said connection network via at least one neuron of said adaptive physical neural network to provide a summation value thereof; comparing said summation value to a threshold value and emitting a pulse if a current activation state exceeds said threshold value; and automatically grounding or lowering to -Vcc a post synaptic junction associated said at least one neuron during emission of said pulse, thereby causing at least one synapse in receipt of a pre-synaptic activation to experience an increase in a local electric field, such that at least one synapse that contributes to an activation of said at least one neuron experiences an increase in said local electric field parallel to a connection direction associated with said connection network and additionally experiences a higher frequency of activation in order to increase a strength of said nanoconnections.

The Examiner state "that for the purpose of describing in detail when the total sum of inputs are put into a comparator, and if an amount is higher than the voltage node the pulse is discharged".

The Examiner additionally argued that the Tapang concepts in conjunction with nanotechnology of Nagahara and Olson with the design concepts of Mehrotra now teach a solution that is inherent of a hardwired neural network.

Examiner's response:

In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208

USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

16. In reference to the Applicant's argument:

Regarding claim 12, the Examiner admitted that Nagahara, Mehrotra and Olson do not teach at least one neuron of said physical neural network comprising an integrator. The Examiner argued that Tapang teaches at least one neuron of said physical neural network comprising an integrator (citing Tapang, Column 8, Lines 39-57). The Examiner asserted that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings Nagahara, Mehrotra and Olson by having a device which fires a response within certain parameters as taught by Tapang to have at least one neuron of said physical neural network comprising an integrator. The Examiner stated that "for the purpose of having the neuron fire under a pre-synaptic condition of when neuron's excitation level is greater than the neuron's threshold value".

The Applicant respectfully disagrees with this assessment and asserts that the arguments presented earlier herein against Nagahara, Mehrotra and Olson apply equally against the rejection to claims 11 and 12. As indicated previously, Nagahara does not provide for any teaching of a neural network and/or of a physical neural network. Mehrotra, on the other hand, provides no teaching of a physical neural network and no teaching of a physical adaptive neural network and in fact teaches away from a physical neural network. As indicated previously, Mehrotra provides for algorithms decreasing the size of neural networks, but does not provide for any teaching of a physical neural network and physical neural network components such as physical neurons, physical synapses and the like, The Applicant also notes that Olson has been removed as a prior art reference under the Nugent declaration submitted herewith. Thus, Nagahara, Mehrotra, and Olson cannot be properly combined with another reference as a basis for rejecting claims 11 and 12.

Regarding Tapang, the Applicant notes that Tapang does not teach the essential claim limitations of Applicant's claims 11 and 12. For example, claims 11 and 12 utilize the "connection network" taught by Applicant's invention, which is described as follows at Paragraph 56 of Applicant's specification as ".._a connection network composed of a

plurality of interconnected electrodes (i.e., nanoconnections)." Paragraphs 68-69 of Applicant's specification also provide additional language describing the "connection network" of Applicant's invention:

"As illustrated in FIG. 3, nanoconnections 304 comprise a plurality of interconnected nanoconnections, which can be referred to generally as a "connection network." An individual nanoconnection may constitute a nanoconductor such as, for example, a nanowire, a nanotube, nanoparticies(s), or any other nanoconducting structures. Nanoconnections 304 may comprise a plurality of interconnected nanotubes and/or a plurality of interconnected nanowires. Similarly, nanoconnections 304 can be formed from a plurality of interconnected nanoparticles.

A connection network Is thus not one connection between two electrodes, but a plurality of connections between input electrodes and output electrodes. Nanotubes, nanowires, nanoparticles and/or other nanoconducting structures can be utilized, of course, to construct nanoconnectlons 304 between input 302 and input 306."

The Examiner argued that Tapang at Column 10, Lines 17-45 teaches nanoconnections and a connection network. Where are the nanoconnections disclosed in Tapang? Where is a connection network composed of nanoconnections disclosed in Tapang? Certainly not at Column 10, Lines 17-45 of Tapang, nor at Column 8, Lines 58 through Column 9, Line 2 of Tapang, nor at Column 10, Lines 17-45 of Tapang, nor at Column 8, Lines 39-57 of Tapang, all of which were cited by the Examiner. In order for Tapang to teach the claim limitations of Applicant's claims 11 and 12 as argued by the Examiner, Tapang must teach a connection network and nanoconnections. A review of Tapang does not indicate the presence or teaching of any nanometer scale. devices such as the connection. network and nanoconnection taught by Applicant's claims 11 and 12 and specification. In fact as indicated earlier, Tapang teaches away from nanorneter scale devices and components and instead focuses on much larger devices and components.

In fact, Tapang describes a method for refreshing capacitively stored synaptic weights (first sentence of Tapang). It has been demonstrated that capacitively stored synaptic weights are limited in their ability to form very large and adaptive physical neural systems. The use of nanoparticles to emulate and adaptive synapse alleviates this problem. In other words, the Applicant is claiming a solution to a problem inherent in the design of Tapang. The Applicant invites the Examiner to review Tapang again to determine if there is any teaching of nanometer scale devices, a connection network, nanoconnections and the like. The Applicant submits that the contrary is the case.

Based on the foregoing, the Applicant submits that the rejection to claims 11 and 12 fails under all three prongs of the aforementioned prima fade obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the

reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claims 11 and 12, including all of the claim limitations of the claims from which claims 11 and 12 depend. Second, there Is not a reasonable expectation of success for such a combination, particularly in light of the fact that Tapang provides absolutely no teaching or suggestion of a connection network and nanoconnections as taught by Applicant's invention and Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.
Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the Invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claims 11 and 12 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of, sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claims 11 and 12 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claims 11 and 12.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Tapang teaches an integrator. Tapang is used in combination of Olson. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya,

184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

17. In reference to the Applicant's argument:

Olson, Mehrotra

Claims 13, 15, 16, 17, 21, and 22 were rejected by the Examiner under 35 U.S.0 103(a) as being unpatentable over Olson in view of Mehrotra.

Regarding claim 13, the Examiner argued that Olson teaches providing a physical neural network comprising a plurality of neurons connected via a plurality of nanoconductors disposed within a dielectric solution to form at least one connection network of nanoconnections thereof, wherein said nanoconnections transfer signals. In support of this argument, the Examiner cited Olson, Lines 1-15 and argued that Olson teaches a neural network composed of nanotechnology resulting in nanoconnections which in turn transfer signals. The Examiner asserted that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings of Nagahara and Mehrotra by using nanotechnology in the form of neural networks as taught by Olson's physical neural network until said at least one output changes to a desired output.

The Examiner asserted that Mehrotra teaches presenting an Input data set to said physical neural network to produce at least one output thereof; and increasing network activity within said physical neural network until said at least one output changes to a desired output. In support of this argument, the Examiner cited Mehrotra, page 122, FIG. 4,9(a) and provided an EN asserted that there are 3 input nodes for a

single output node. The Examiner argued that It would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the teachings of Nagahara by illustrating the basic design of a neural network as taught by Mehrotra to present an input data set to said physical neural network to produce at least one output thereof; and increasing network activity within said physical neural network until said at least one output changes to a desired output. The Examiner stated "the purpose being to take advantage of dynamic connections ability to generate an adaptive neural network".

The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 13. The rejection to claim 13 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 13, including all of the claim limitations of the claims from which claim 13 depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that decrease the size of simulated neural networks. Third, there is simply no teaching of a the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 13 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 13 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 13.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

18. In reference to the Applicant's argument:

Regarding claim 15, the Examiner argued that Olson teaches that said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by said nanoconnections, each of said nanoconnections being associated with a weight; and said increasing said network activity within said physical neural network includes scaling a

weight associated with said nanoconnections by a positive factor. In support of this argument, the Examiner cited Olson, Lines 1-15 and argued that the term "weight" of Applicant's claim 15 is equivalent to "strengthen or weaken connections" of Olson. The Examiner also argued that the "Positive factor" of Applicant's claim 15 Is equivalent to "electrical fields" and their effect on nanoparticles.

The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 15. The rejection to claim 15 fails under all three prongs of the aforementioned prima fade obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 15, including all of the claim limitations of the claims from which claim 15 depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further falls to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 15 under 35 U.S,C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.G. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 15 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 15.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

19. In reference to the Applicant's argument:

Regarding claim 16, the Examiner argued that Olsen teaches that a plurality of neurons comprises a plurality of interconnected neurons that are Interconnected by nanoconnections for transferring signals having a magnitude in a firing state (the Examiner cited Olsen, lines 1-15, and argued that neural networks that composed of nanotechnology comprise interconnecting neurons and nanoconnections; and that the "magnitude" of the Applicant is equivalent to "strengthen or weaken" of Olson); and said Increasing said network activity within said physical neural network includes increasing said magnitude of said signal in said firing state. (citing Olson, arguing that "increasing

said magnitude" of Applicant is equivalent to "increasing electrical field of Olson and arguing that this results in an increased signal of the Applicant or strengthening connections of Olson).

The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 16. The rejection to claim 16 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 16, including all of the claim limitations of the claims from which claim 16 depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms intended to decrease the size of simulated neural networks. Third, there Is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill In the art would be motivated to make such a combination, and further falls to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed, The rejection to claim 16 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 16 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 16.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

20. In reference to the Applicant's argument:

Regarding claim 17, the Examiner argued that Olson teaches that said plurality of neurons comprises a plurality of interconnected neurons that are interconnected by a plurality of data input neurons-thereof adapted to receive respective external signals (citing Olson, Lines 1-15; and arguing that "neurons" and "interconnected neurons" of the Applicant is equivalent to the "neural network" of Olson; and said increasing said network activity within said physical neural network includes increasing a magnitude of said respective external signals (citing Olson, Lines 1-15; and arguing that "increasing a magnitude of said respective external signals" of Applicant is equivalent to increasing electrical fields of Olson).

The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 17. The rejection to claim 17 fails under all three prongs of the aforementioned prima fade obviousness test. First, there is no suggestion or motivation, either In the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 17, including all of the claim limitations of the claims from which claim 17 depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms intended to decrease the size of simulated neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not be taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 17 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 17 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 17.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a

connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

21. In reference to the Applicant's argument:

Regarding claim 21, the Examiner admitted that Olson does not teach providing said desired output data; and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output.

The Examiner argued that Mehrotra teaches providing said desired output (citing Mehrotra, page 116, lines 1-6; and arguing that "Desired output data" of Applicant is equivalent to "training samples are needed" of Mehrotra); and comparing said desired output data and said output to generate said signal in response if said desired output data is not equal to said output. (citing Mehrotra, page 118, lines 23-24; arguing that using comparing symbols like "less than" or "subset" is one way to compare output data with a desired output).

The Examiner asserted that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the teachings of Olson by

introducing training data for the neural network as taught by Mehrotra to provide said desired output data; and comparing said desired output data and said output to generate said signal in response if said desired output is not equal to said output. The Examiner stated that for the purpose of providing the ability of the neural network to learn new functions or situations".

The Examiner further argued that Applicant's arguments are based on the existence of a "physical" and nanotechnology based neural network. The Examiner asserted that if Mehrotra's neural network runs on a computer then it is physical due to the fact that the computer is `physical". The Examiner further argued that Mehrotra never claims to be based on nanotechnology, but Olson is, and that Mehrotra is used to illustrate the design of an adaptive neural network.

The Applicant respectfully disagrees with this assessment. Mehrotra is directed toward algorithms that decrease the size of simulated neural networks and in no way teaches a true physical neural network like Applicant's invention. It is clear that the Examiner has not understood the difference between a simulated neural network and a physical neural network as described by the Applicant. The term "physical" is used in reference to "physics" in that the physics of the device are used to implement the neural network, particularly the adaptive function. Saying that Mehrotra's neural network is a physical neural network because it is run on a computer is like saying a car crash is a real car crash because it is simulated on a computer. In both a real car crash and a simulated car crash, the result (theoretically) can be obtained. However, in the case of actually crashing the car, the result was obtained by the physical interaction of the component parts whereas in the computer it was the result of many mathematical calculations such as multiplication and addition.

Running an algorithm on a computer only produces information of a mathematically defined algorithm and the algorithm does not have to bear any relation to a physical object. A physical neural network is composed of distinct circuits representing each neuron and each synapse in the network. It is a "one-to-one" mapping or alternately a "direct implementation". In a physical neural network, every computational step inherent in the neural network is accomplished directly by the Interaction of its component parts and the final (computational) result is obtained from the physics of the device, not the mathematics. Thus, the Examiner is incorrect that if Mehrotra's neural network runs on a computer it is "physical" due to the fact that the computer Is "physical". The only "neural network" that Mehrotra teaches are based on algorithms that simulate neural networks.

Regarding Olson, the Applicant notes that Olson at Lines 1-15 cited by the Examiner makes no mention of an adaptive neural network.

The Applicant submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 21. The rejection to claim 2 1fails under all three prongs of the aforementioned prima facie

obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 21, Including all of the claim limitations of the claims from which claim 21depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further falls to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 21 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason .and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 21 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 21.

Examiner's response:

Mehrotra teaches neural networks. Neural networks can be either hardware based or software based. Both types can be trained. Nagahara teaches the basic design of a neuron. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that

references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

22. In reference to the Applicant's argument:

Olson, Mehrotra, Nagahara
Claims 14, 18, 19, and 20 were rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Olson and Mehrotra, as set forth above, in view of Nagahara.

Regarding claim 14, the Examiner admitted that Olson and Mehrotra do not teaching increasing said network activity within said physical neural network, further comprising the step of increasing a number of firing neurons in said physical neural network.

The Examiner argued that Nagahara teaches increasing said network activity within said physical neural network, further comprising the step of increasing a number of firing neurons in said physical neural network. In support of this argument, the Examiner cited Nagahara, page 3826, Column 1, Line 20 through Column 2, Line 8, and argued that the "increase of network of activity" of Applicant is equivalent to the "placement yield" of Nagahara"; and that "increasing the number of firings" of Applicant is equivalent to "applying a DC bias of Nagahara").

The Examiner argued that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined

teachings of Olson and Mehrotra by making a direct correlation between the number of firing neurons and "network activity" as taught by Nagahara to illustrate increasing the network activity within said physical neural network, further comprises the step of increasing a number of firing neurons in said physical neural network. The Examiner stated that for the purpose of illustrating a direct correlation between firing neurons and network activity".

The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 14. The rejection to claim 14 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill In the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 14, including all of the claim limitations of the claims from which claim 14 depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, In effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill In the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 14 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which Is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 14 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 14.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

23. In reference to the Applicant's argument:

Regarding claim 18, the Examiner admitted that Mehrotra and Olson do not teach said plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold; and said increasing said network activity within said physical neural network includes lowering said threshold.

The Examiner argued that Nagahara teaches said plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being

configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold (citing Nagahara, page 3827, Column 1, lines 26-36; and arguing that the "excitation level" of Applicant is equivalent to "above 1 MH" of Nagahara); and said increasing said network activity within said physical neural network includes lowering said threshold (citing Nagahara, page 3826, Column 2, Lines .6-8; and arguing that "increase network activity" and "lower threshold" of Applicant is equivalent to "choice of frequency" "dramatically enhances" of Nagahara).

The Examiner asserted that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings of Mehrotra and Olson by illustrating by using the correct frequency will enhance encourage the placement of nanoparticles between the electrons as taught by Nagahara to have plurality of neurons comprises a plurality of interconnected neurons, each of said interconnected neurons being configured to fire when a corresponding excitation level thereof is greater than or equal to a threshold; and said increasing said network activity within said physical neural network includes lowering said threshold.

The Examiner stated that "for the purpose of using electrical fields to generate connections between electrodes and using the fact that until a given level of electrical field is applied a connection will not be formed can be seen as a threshold." The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 18. The rejection to claim 18 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 18, including all of the claim limitations of the claims from which claim 18 depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S,C 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of a the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings

necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 18 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

The Examiner stated that "for the purpose of using electrical fields to generate connections between electrodes and using the fact that until a given level of electrical field is applied a connection will not be formed can be seen as a threshold." The Applicant respectfully points out that the Examiner has confused the synaptic modification process with neural activation. A neuron is activated by summing inputs that are attenuated by synapses. A strong synapse can only activate a neuron if its input is also activated. A neural threshold and a threshold for synaptic formation are two completely different things.

Based on the foregoing, the Applicant submits that the rejection to claim 18 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 18.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217

USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

24. In reference to the Applicant's argument:

Regarding claim 19, the Examiner admitted that the combination of Mehrotra and Olson do not teach determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections, said nanoconnections being associated with respective weights, and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval.

The Examiner asserted that Nagahara teaches determining said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections, said nanoconnections being associated with respective weights (citing Nagahara, page 3836, column 1 line 35 through column 2, line 8; and arguing that with the use of additional inputs into one electrode would be the equivalent to "weighted sum" of Applicant); and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval (citing Nagahara, Abstract; arguing that the completed nanoscale wiring would be completed within seconds).

The Examiner asserted that it would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings of Mehrotra and Olson by using the combined input as combined weights as taught by Nagahara to determine said excitation level of at least one neuron of said plurality of neurons based on a weighted sum of input signals received over respective nanoconnections, said nanoconnections being associated with respective weights, and adjusting each of said weights when said at least one neuron of said plurality of neurons and a corresponding one of said others of said neurons fire within a prescribed time interval. The Examiner stated that "for the purpose of using the combined electrical input as combined weights for use in a neural network".

The Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 19. The rejection to claim 19 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either In the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 19, including all of the claim limitations of the claims from which claim 19 'depends. Second, there is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of ji the claim limitations by the references when combined as argued by the Examiner.

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references in order to yield the invention as claimed. The rejection to claim 19 under 35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 19 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 19.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection

network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

25. In reference to the Applicant's argument:

Regarding claim 20, the Examiner admitted that the combination of Mehrotra and Olson do not teach increasing said network activity within said physical neural network in response to a signal.

The Examiner argued that Nagahara teaches increasing said network activity within said physical neural network in response to a signal (citing Nagahara, arguing that "increasing activity" and "response to a signal" of Applicant is equivalent to "placement of CNT" and "choice of frequency" of Nagahara).

The Examiner argued that It would have been obvious to a person having ordinary skill in the art at the time of Applicant's invention to modify the combined teachings of Mehrotra and Olson by stating the relationship between electrical input and connections between electrodes as taught by Nagahara to have increasing said network activity within said physical neural network in response to a signal. The Examiner stated that "for the

purpose of electrical input as a mechanism for generating a connection between electrodes".

he Applicant respectfully disagrees with this assessment and again submits that all of the arguments presented earlier against Mehrotra and/or Nagahara and/or Olson apply equally against the rejection to claim 20. The rejection to claim 20 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings as argued by the Examiner to teach each and every claim limitation of Applicant's claim 20, including all of the claim limitations of the claims from which claim 20 depends. Second, there Is not a reasonable expectation of success for such a combination, particularly in light of the fact that Olson does not constitute a reference under 35 U.S.0 103(a) (i.e., see the Nugent declaration), Mehrotra provides no teaching or suggestion of a physical neural network, and Nagahara provides no teaching of a neural network let alone a physical neural network. Mehrotra does not provide for any teaching of a true physical neural network, but hints only at the best, of algorithms that simulate neural networks. Third, there is simply no teaching of all the claim limitations by the references when combined as argued by the Examiner,

Regarding the issue of motivation, the Applicant reminds the Examiner that the language of the references may not taken out of context and combined without motivation, in effect producing the words of the claims (and sometimes, not even the words or concepts of the claims), without their meaning or context. The resultant combination would not yield the invention as claimed. The claims are rejected under 35 U.S.C. §103(a) and no showing has been made to provide the motivation as to why one of skill in the art would be motivated to make such a combination, and further fails to provide the teachings necessary to fill the gaps in these references in order to yield the Invention as claimed. The rejection to claim 20 under.35 U.S.C. §103(a) has provided no more motivation than to simply point out the individual words of the Applicant's claims among the references, but without the reason and result as provided in the Applicant's claims and specification, and without reason as to why and how the references could provide the Applicant's invention as claimed. Hindsight cannot be the basis for motivation, which is not sufficient to meet the burden of sustaining a 35 U.S.C. §103(a) rejection.

Based on the foregoing, the Applicant submits that the rejection to claim 20 has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 20.

Examiner's response:

Nagahara teaches the basic design of a neuron. Mehrotra teaches the design of a neural network. Olson has not been removed as prior art. Olson teaches a connection network and nanoconnections. In response to Applicant's argument that there is no suggestion to combine the references, the Examiner recognizes that references cannot be arbitrarily combined and that there must be some reason why one skilled in the art would be motivated to make the proposed combination of references. In re Nomiya, 184 USPQ 607 (CCPA 1975). However, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re Keller, 648 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983); In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA 1969).

Examination Considerations

26. The claims and only the claims form the metes and bounds of the invention. "Office personnel are to give the claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris*, 127 F.3d 1048, 1054-55, 44USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater*, 415 F.2d, 1393, 1404-05, 162 USPQ

541, 550-551 (CCPA 1969)" (MPEP p 2100-8, c 2, l 45-48; p 2100-9, c 1, l 1-4). The Examiner has the full latitude to interpret each claim in the broadest reasonable sense. Examiner will reference prior art using terminology familiar to one of ordinary skill in the art. Such an approach is broad in concept and can be either explicit or implicit in meaning.

27. Examiner's Notes are provided to assist the applicant to better understand the nature of the prior art, application of such prior art and, as appropriate, to further indicate other prior art that maybe applied in other office actions. Such comments are entirely consistent with the intent and sprit of compact prosecution. However, and unless otherwise stated, the Examiner's Notes are not prior art but link to prior art that one of ordinary skill in the art would find inherently appropriate.

28. Examiner's Opinion: Paragraphs 26 and 27 apply. The Examiner has full latitude to interpret each claim in the broadest reasonable sense.

Conclusion

29. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

30. Claims 1-3, 5-22 are pending.

Correspondence Information

31. Any inquiry concerning this information or related to the subject disclosure should be directed to the Examiner Peter Coughlan, whose telephone number is (571) 272-5990. The Examiner can be reached on Monday through Friday from 7:15 a.m. to 3:45 p.m.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor David Vincent can be reached at (571) 272-3687. Any response to this office action should be mailed to:

Commissioner of Patents and Trademarks,

Washington, D. C. 20231;

Hand delivered to:

Receptionist,

Customer Service Window,

Randolph Building,

401 Dulany Street,

Alexandria, Virginia 22313,

(located on the first floor of the south side of the Randolph Building);

or faxed to:

(571) 273-8300 (for formal communications intended for entry.)

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have any questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

Peter Coughlan

6/22/2006